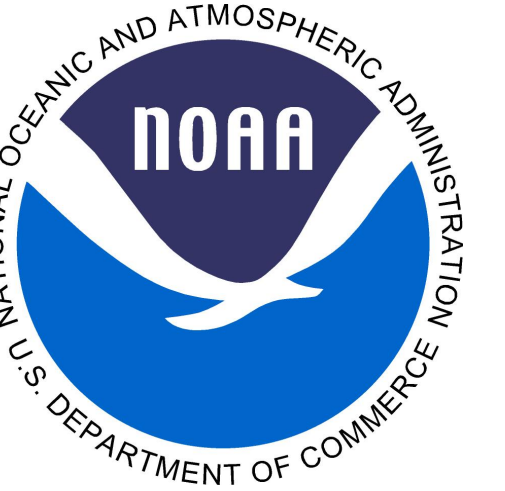


Aerosol size distributions measured onboard Ronald H. Brown: Variability in relation to sources, processing, and meteorology

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Introduction

Aerosol size distributions were measured onboard the NOAA RV *Ronald H. Brown* during TexAQS-GoMACCS 2006 to help characterize the impact of aerosols on air quality and climate. Size distributions were collected over a diameter range of 0.020 to 10 μm at a constant RH of 60%.

As described here, variability in the measured size distributions is a function of the different aerosol sources and wind regimes encountered.

Figure 1. Surface Area size distributions for the entire cruise. The bar at the bottom indicates the times of the three regional periods.

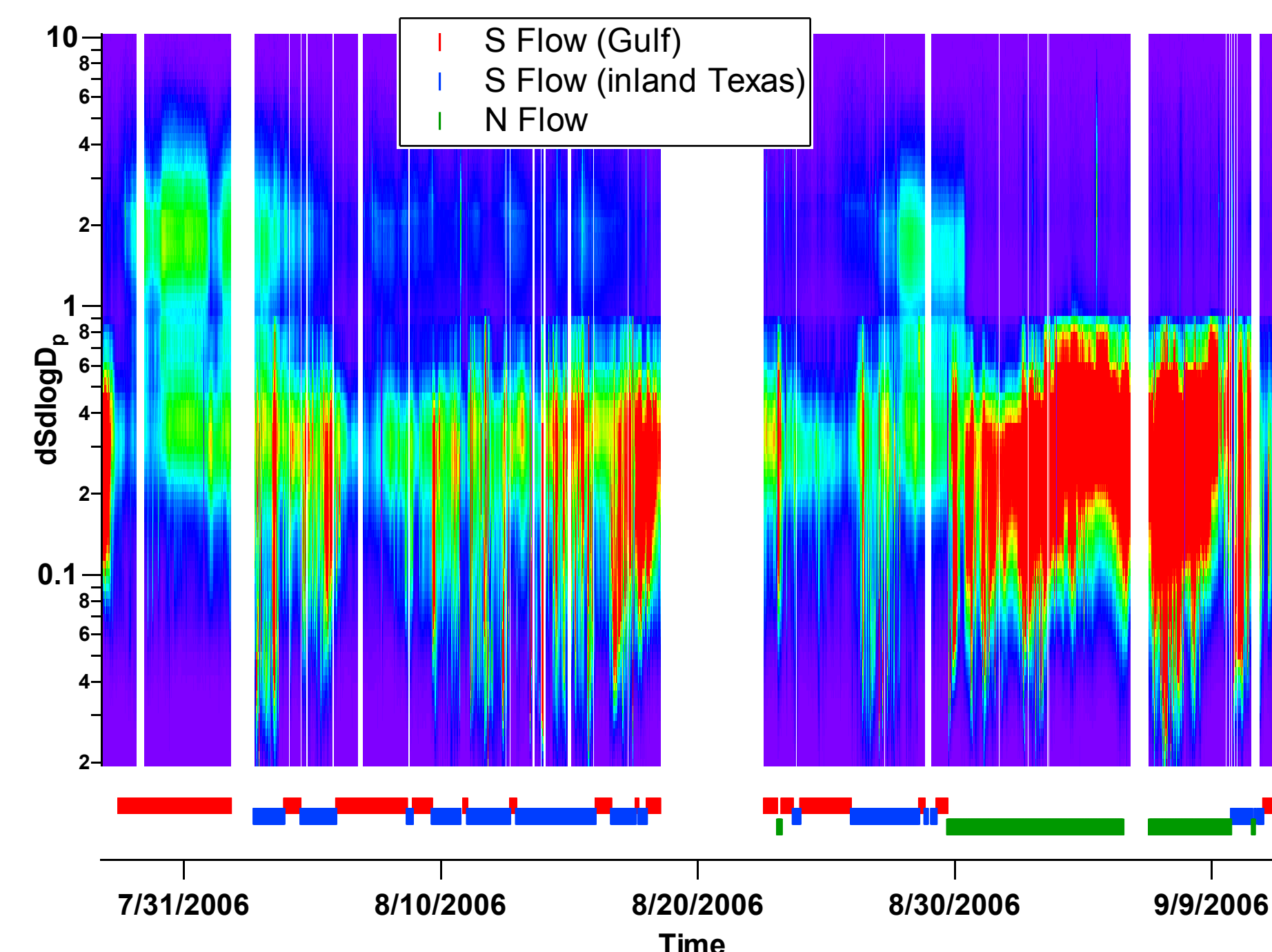
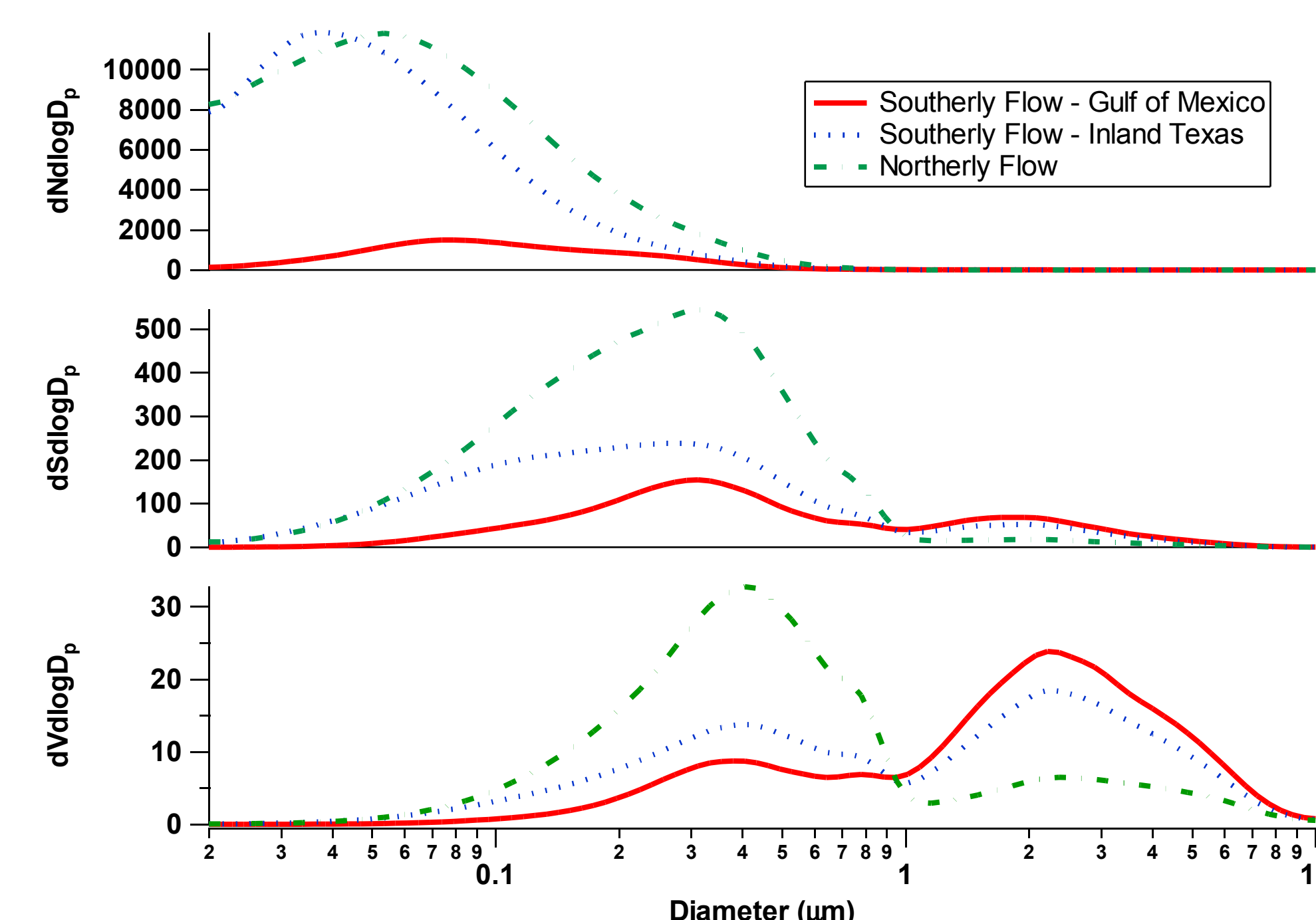


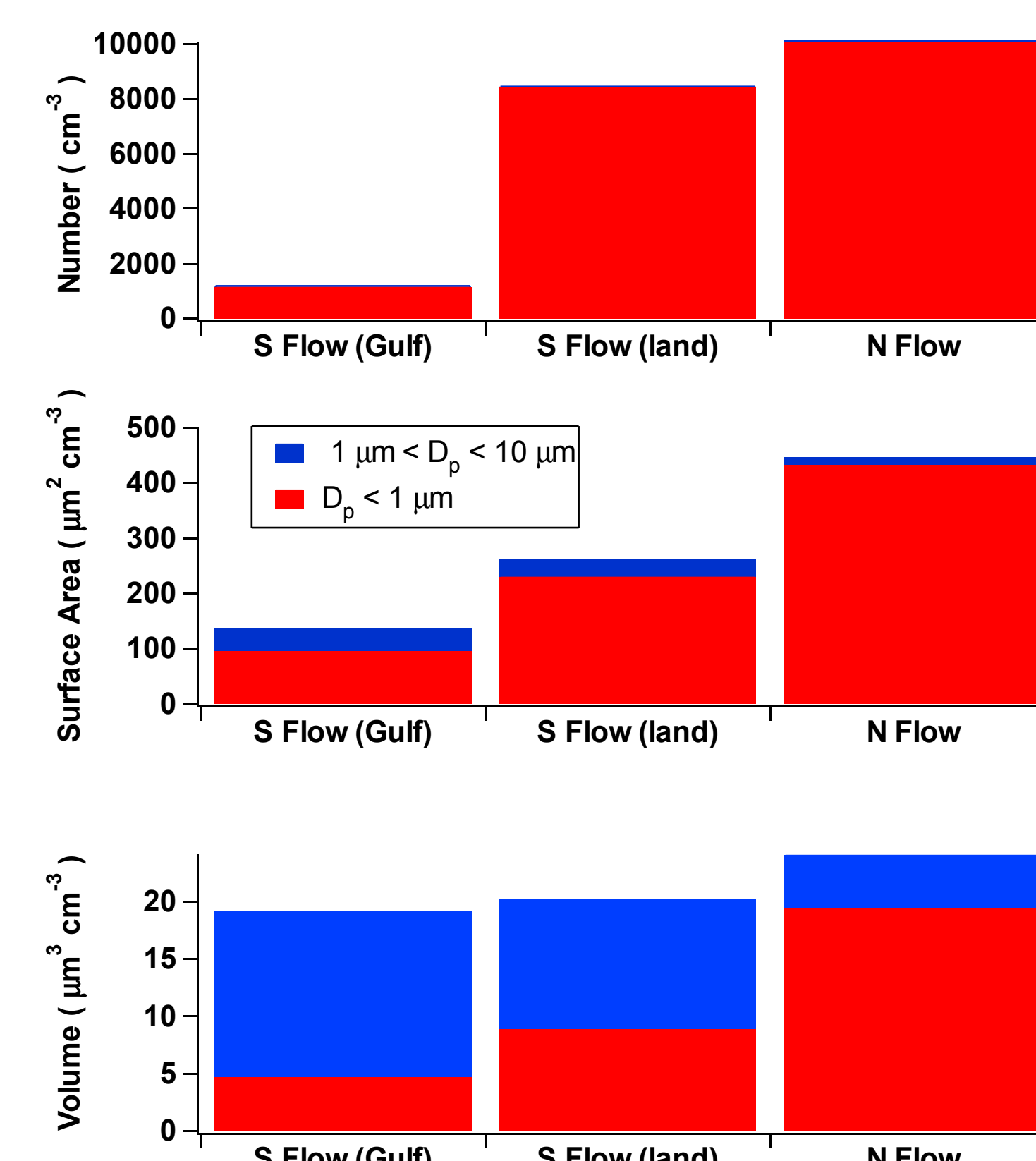
Figure 2. Average Number, Surface Area, and Volume distributions for the three regional periods.



Variability due to different wind flow regimes

Three different wind flow regimes are examined: Southerly flow from the Gulf of Mexico (background aerosol advecting into Texas), southerly flow from inland Texas (background aerosol with local sources added), and Northerly flow [Figures 1-3, 5].

Figure 3. Integral Number, Surface Area, and Volume for the three regional periods as sub and supermicron.



Variability due to different source regions

Shown in Figure 4 are average Number, Surface Area and Volume distributions for selected periods to give "snapshots" of different source regions within the three wind flow regimes shown above. These source regions include: Saharan dust, low aerosol concentrations (southerly flow from the Gulf of Mexico), periods of northerly and southerly flow while the ship was in the Houston Ship Channel (HSC), and periods of northerly and southerly flow while the ship was on station in Barbours Cut (BC). This final region, southerly flow in BC, shows the effect of local port operations.

Figure 4. Average Number, Surface Area, and Volume distributions for different source regions.

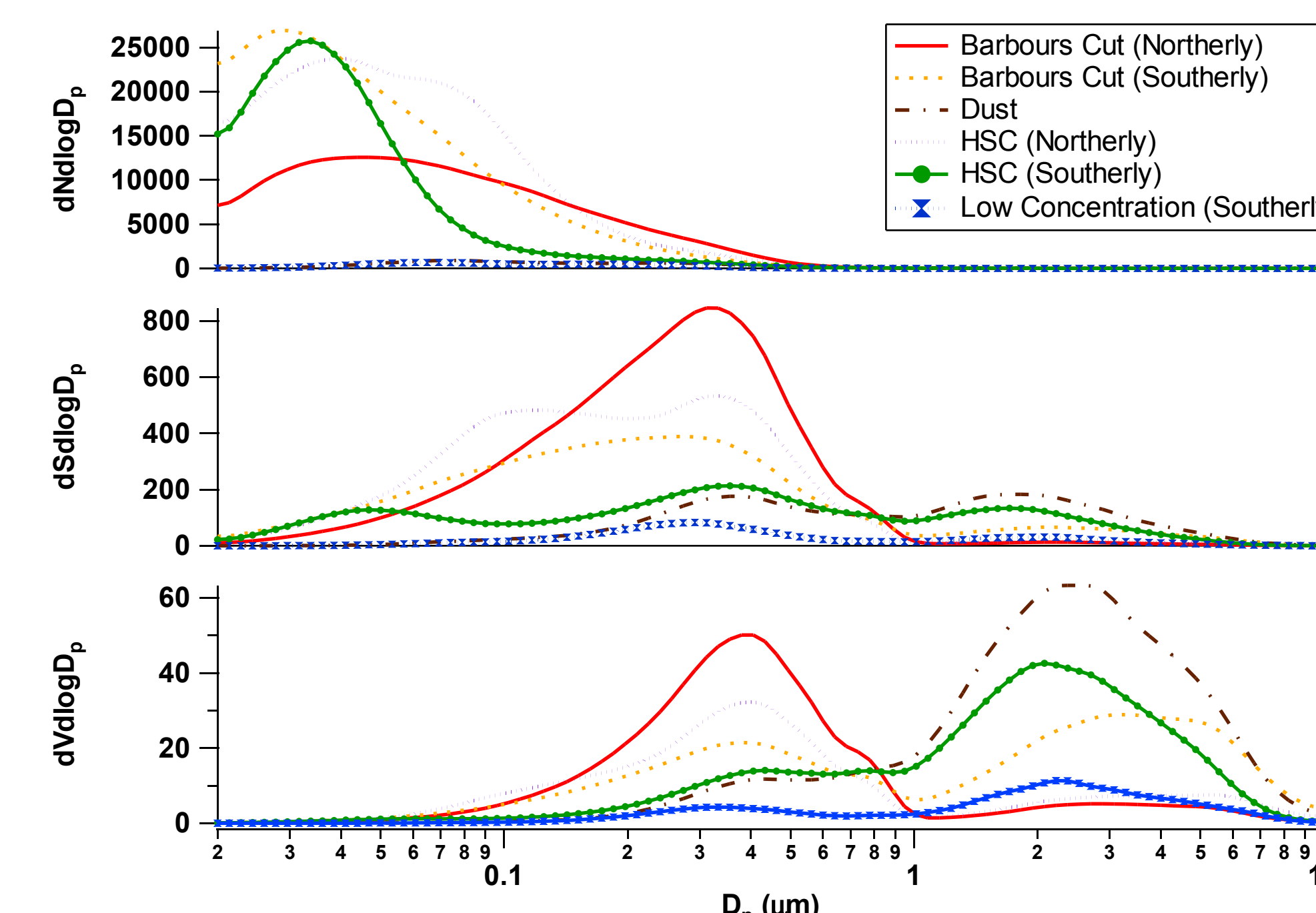


Figure 5. CCN critical diameter, sub and supermicron extinction and sub and supermicron mass for the three regional periods.

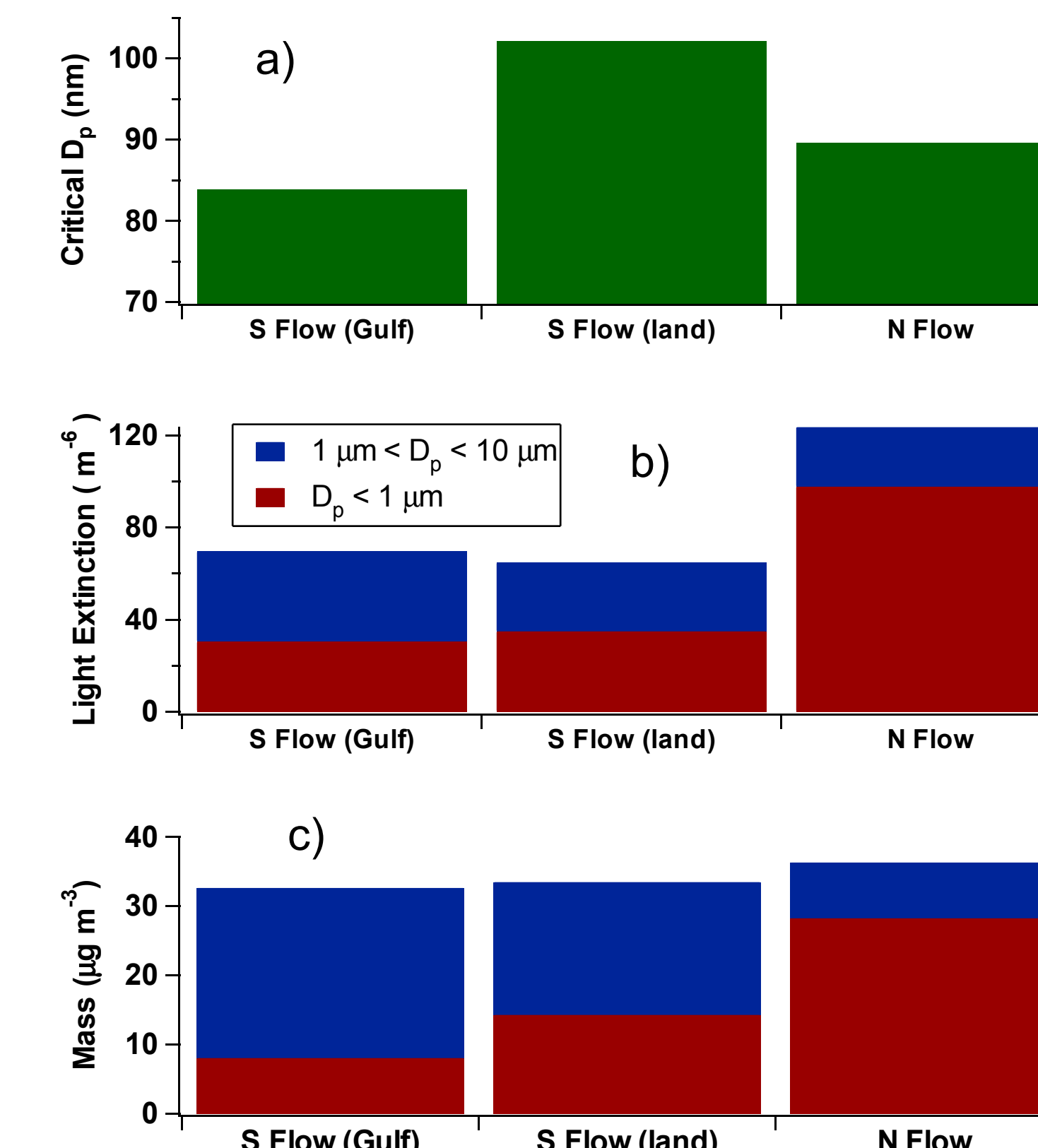
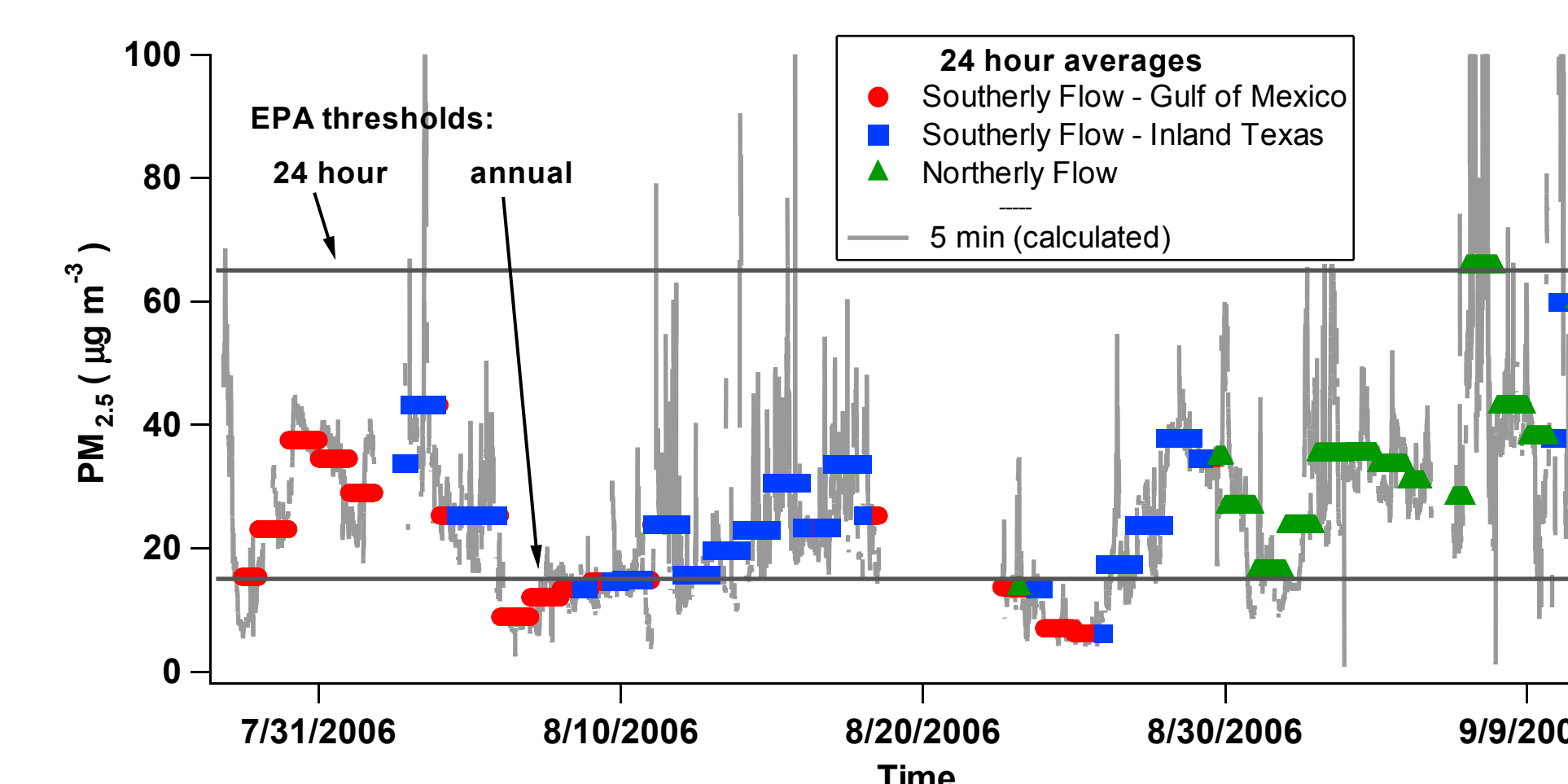


Figure 6. 24 hour averaged PM_{2.5} calculated from measured size distributions, shifted to ambient RH.



Conclusions

Younger aerosol from the Southerly (inland) case have a smaller number mean diameter than the more aged Northerly aerosol due to less processing and time for growth [Figure 2]. Both have much higher concentrations than the Southerly (Gulf) case.

The larger number mean diameter of the Northerly flow case translates into larger surface area and volume concentrations for the submicron fraction [Figure 2].

Saharan Dust was present in both Southerly flows and adds significant surface area and volume to the supermicron fraction [Figure 2].

Source regions of Northerly flow [Figure 4] also have larger Number mean diameters due to the more aged aerosol.

Large coarse modes due to Saharan dust are present for regions with southerly flow [Figures 2, 4]. HSC (Southerly) may be an exception as it could also be due to local sources from port operations.

CCN critical diameters [Figure 5a] are dependent on the number size distribution and the composition of the aerosol. See the Quinn *et al.* poster for more details.

Total light extinction [Figure 5b] for the two southerly wind regimes are similar despite the differing surface area size distributions [Figure 2]. Total light scattering for the Northerly flow regime is larger despite the similar total mass of all three regimes [Figure 5c]. See the Covert *et al.* poster for more details.

Total mass [Figure 5c] is almost identical for the three wind flow regimes even though the size distributions are very different.

PM_{2.5} mass calculated [Figure 6] from the size distributions show that the EPA limit for 24 hours was exceeded only once during the Northerly flow regime while the PM_{2.5} mass was above the annual limit for most of the cruise.

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